

6.4 San Juan Islands

A. Assessment

1. Salmon Use

Chinook

This is part of the South Georgia Straits and San Juan Islands regions, which includes independent populations in the Nooksack river system but none from the streams draining directly to this sub-basin.

a) Juvenile

- Juvenile Chinook salmon from multiple non-natal populations from all Geographic Regions of origin utilize this sub-basin for feeding and growth, refuge, physiological transition and as a migratory corridor (juvenile salmon functions) (See Figure 3-1 for a list of all Chinook populations).

b) Adult

- Sub-adult and adult salmon from Puget Sound populations utilize habitats within this sub-basin as a migratory corridor and foraging area.
- Adult salmon from far outside Puget Sound (e.g., Columbia River and Snake River ESU's) may utilize habitats within this sub-basin as a migratory corridor and foraging area.

Other Listed Species (not comprehensively reviewed or assessed for this sub-basin)

- Chum salmon: Populations of the Hood Canal/Eastern Strait of Juan de Fuca Summer Chum ESU do not emanate from this sub-basin. Non-natal use may occur, but it is not known for certain.
- Bull trout (anadromous): Preliminary core populations (from core areas) within the Puget Sound Management Unit of bull trout are not present in this sub-basin.

2. Ecological and Landscape Conditions

Food Web, Ecological Conditions

The San Juan Islands are unique in their location and as such, are an important corridor for adult fish from all populations. Forage fish and eelgrass are important components of the San Juan Islands' ecology. Forage fish require functioning nearshore habitats for spawning and rearing. Forage fish are critical prey items for salmon, as well as to marine mammals and birds.

In 2004, Friends of the San Juans produced a forage fish spawning habitat study report revealing forage fish spawning habitat regions within the archipelago. Four priority forage fish spawning habitat regions were identified: Mud/Hunter Bay region on Lopez Island; Westsound and Blind

Bay Region on Orcas and Shaw islands; Mackaye Harbor Region on Lopez Island; and Greater Westcott Bay Region on San Juan Island.

Landscape Conditions

Rocky shorelines dominate the San Juan Islands therefore, there is less perceived need for armoring. Protected shorelines of inner bays may be important for forage fish spawning because that is where the appropriate sediment grain sizes settle out. Wind and waves cause large vertical zonation of intertidal flora and fauna on some shorelines within the sub-basin.

Connectivity of habitats suitable for forage fish spawning is limited so the importance of support functions for rearing forage fish may be more important than spawning habitat here. Continuity of eelgrass and kelp beds are important to migrating juvenile and sub-adult salmon from all 22 populations of Chinook and the populations of Hood Canal/Eastern Strait of Juan de Fuca Summer chum. The importance of Haro Strait and other passes between the larger San Juan Islands as corridors for migrating adult salmon indicate an importance for Southern resident orca populations that rely on adult salmon for food.

See Figures E-3.1 through 3.3, E-4.4 and 4.5 in Appendix E for information about the landscape conditions in this sub-basin

Overall area

- Total area (deep-water plus nearshore) is 181,887 acres (284.2 square miles).
- Deep-water portion (marine waters landscape class) comprises 146,175 acres (228.4 square miles), or 80% of the total sub-basin area.

Nearshore area

- Nearshore portion comprises 35,776 acres (55.9 square miles), or 20% of the total sub-basin area. A natal estuary (landscape class) is not present in this sub-basin.
- Nearshore area within this sub-basin is 8% of the nearshore area of the entire Puget Sound basin.
- Contains 387 miles of shoreline (beaches landscape class).
- Numerous smaller bays can be found in the San Juan Island complex. Some of the bays (landscape class) identified in this sub-basin are Echo Bay, East Sound, West Sound, Deer Harbor, Blind Bay, Parks Bay, Burrows Bay, Mud Bay, Hunter Bay, Aleck Bay, Shoal Bay, Swifts Bay, Fishermans Bay, North Bay, Friday Harbor, Reid Harbor, Mitchell Bay, Westcott/Garrison Bay, False Bay, Roche Harbor, and Open Bay.
- Thirty-one linear miles (8%) of the shoreline is designated as marine riparian (defined as the estimated area of length overhanging the intertidal zone).
- In this sub-basin, 43% of the shoreline (168 linear miles) has eelgrass (*Zostera marina* and *Z. japonica*); may be patchy or continuous.
- In this sub-basin, 29% of the shoreline (114 linear miles) has floating kelp; may be patchy or continuous. Also in this sub-basin, 61% of the shoreline (238 linear miles) has non-floating kelp; may be patchy or continuous.

Pocket Estuary Analysis

We identified 29 pocket estuaries in this sub-basin spread throughout many of the larger islands.

- Freshwater sources were observed in over half the pocket estuaries,
- Based on the assumptions listed in Appendix B, all three of the Chinook functions (feeding, osmoregulation and refuge) were estimated to occur in nearly all the pocket estuaries.
- Composite “scores” were generated for each pocket estuary based on likely Chinook functions and stressors observed during analyses. Sixteen pocket estuaries were estimated to be *properly functioning*. Two pocket estuaries were estimated to be *not properly functioning*. The remaining 11 pocket estuaries were recorded as *at risk*.

Drift Cell Analysis

There are many small drift cells operating on soft sediment shorelines of the San Juan Islands between rocky beach areas. Many of the soft sediment depositional features in the islands also rely on upland sediment sources being delivered from small coastal streams. The drift cell characterization for this sub-basin and is presented in Figure E-4.5 and subsequent text in Appendix E. Littoral drift, feeder sources, deltaic processes, deposition, and recommendations for protection and restoration are discussed in Appendix E and highlights of our recommendations for protection and restoration included in Tables 6-8 and 6-9.

Threats/stressors

Loss and/or simplification of delta and delta wetlands

Natal estuaries for Chinook salmon do not occur in this sub-basin. No information is presented for smaller, non-natal deltas and delta wetlands.

Alteration of flows through major rivers

Larger-scale flow alterations are not present in this sub-basin. Smaller dams and diversions likely exist but are not identified here.

Modification of shorelines by armoring, overwater structures and loss of riparian vegetation/LWD

Shoreline armoring occurs along 17 miles (4%) of the shoreline (Fig. E-3.3). Over 12 miles of shoreline are classified as 100% armored; greater than 346 miles are classified as 0% armored. The total number of overwater structures in this sub-basin is 3,642, consisting of ramps (56), piers and docks (507), small slips (3,065) and large slips (14). Railroads do not occur in this sub-basin.

Contamination of nearshore and marine resources

The nearshore and marine waters of this sub-basin are in relatively good condition compared to other regions of Puget Sound, but the potential for contamination exists. Potential non-point sources of contamination identified in the San Juan County Watershed Management Action Plan (2000) include on-site septic systems, conversion of lands to residential and commercial development, stormwater runoff, agricultural practices, forestry practices, marinas and boating activities, and solid waste/hazardous waste. Of these, on-site septic systems, conversion of lands, and stormwater runoff were ranked as primary pollution sources. Location-specific pollution sources were specified in the report.

See Fig. E-3.3 in Appendix E for a depiction of water quality impairments in this sub-basin.

Alteration of biological populations and communities

Only one hatchery is found within the sub-basin and shellfish aquaculture operations are limited to small-scale oyster string culture operations in several embayments.

Transformation of land cover and hydrologic function of small marine discharges via urbanization

At this point, urbanization only seems to be negatively affecting one pocket estuary in any significant way and that is Roche Harbor on San Juan Island. See Figure E-4.4 in Appendix E for a list of this sub-basin's pocket estuaries and stressors noted in our review of oblique aerial photos.

Transformation of habitat types and features via colonization by invasive plants

Spartina spp is not found here. Also, 44% of the shoreline (171 miles) contains *Sargassum muticum*, which may be patchy or continuous.

B. Evaluation

In this section we list goals and evaluate the level of realized function for natal and non-natal Chinook, summer chum, and bull trout. From this we then list each of the proposed protection and restoration actions for this sub-basin, and describe the benefits to natal Chinook, non-natal Chinook, and summer chum and bull trout (if any).

Goals for listed salmon and bull trout whose natal streams are outside this sub-basin

- a) Provide support (migratory corridor and foraging functions) for all neighboring Puget Sound populations (sub-adult and adult), as well as support for adult salmon from Columbia and Snake River ESU's.
- a) Provide for connectivity of habitats; also, adequate prey resources, marine foraging areas, and migratory corridors for sub-adult and adult Chinook.

- b) Improve the knowledge of understanding of the diversity of life history type use in this sub-basin (i.e., it's not just juveniles, it's sub-adults and adults). Potential for large diversity (fish ranging in size from 60 to 150 mm (i.e., different age classes)).

Realized function for listed salmon and bull trout

Fry migrant Chinook – Only the easternmost shorelines of this sub-basin are within ten miles of natal deltas in the South Georgia Strait so few if any fry migrants are expected to use this sub-basin unless extreme flood events force small fish in that direction (Fig. E-3.2). In that event, low energy shorelines are available for rearing but few pocket estuaries are present.

Post-migrant young-of-year Chinook – Outmigrants from many populations could reach the San Juan Islands and find support by the diversity of landscape classes found there. For post-migrant juveniles, forage fish production becomes an important component of salmon survival. Competition with pink salmon for prey resources during even-numbered years may potentially impact Chinook salmon survival.

Sub-adult and adult Chinook – We hypothesize that the survival of sub-adult and adult Chinook salmon is greatly dependent on the production and availability of forage fish species within nearshore regions of this sub-basin. In addition, marine vegetation such as eelgrass and kelp also play an important role in salmon survival. As in the South Georgia Strait sub-basin during even-numbered years, competition with pink salmon for prey resources may impact Chinook salmon survival.

Summer Chum – We hypothesize that Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon do not use this sub-basin.

Bull Trout – We hypothesize that anadromous bull trout do not use this sub-basin

Table 6-8. Recommended protection actions for the San Juan Islands

Protection Action	Benefit to Natal Chinook	Benefit to Other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Protect diversity of habitats (e.g., eelgrass, kelp) important for sustaining forage fish species throughout their life history, not just spawning habitat		Sustained feeding and growth of juveniles, sub-adults, and adults of all populations	Sustained feeding, growth, migration functions for all species
Aggressively protect the 16 pocket estuaries designated in this analysis as properly functioning		Sustained feeding, refuge, migration and growth of juveniles, sub-adults, and adults of all populations	Sustained feeding, growth, migration functions for all species

Protection Action	Benefit to Natal Chinook	Benefit to Other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Protect against catastrophic events (many different populations use this sub-basin)		Sustained migration functions for all populations	Sustained migration functions for all species
Protect shoreline protection targets 1,2, 5, and 7-14		Sustained feeding function through forage fish production for all populations	Sustained feeding function through forage fish production for all species
Protect upland sediment sources within shoreline protection targets 3,4 and 6		Sustained feeding, refuge and migratory functions for all populations	Sustained feeding, refuge and migratory functions for all species

Table 6-9. Recommended improvement actions for the San Juan Islands

Improvement Action	Benefit to natal Chinook	Benefit to Other (non-natal) Chinook	Benefit to summer chum, bull trout, other fish
Protect juvenile salmon along shorelines by revisiting or revising the timing of in-water activities (e.g., construction, etc.) later in the calendar year (i.e., juvenile salmon are found to utilize nearshore regions later in the year than previously thought)		Improved growth, migration functions for all populations	Improved growth, migration for all species
Consider wastewater reclamation and reuse retrofits for Friday Harbor, Roche Harbor, Orcas and Rosario wastewater discharges		Improved feeding and refuge functions for all populations	Improved feeding and refuge for all species

6.5 Admiralty Inlet

A. Assessment

In this section we assess salmon and bull trout use, food web and ecological condition, landscape condition, and threats.